GEOGRAPHIC INFORMATION SYSTEMS (GIS)

"A REVIEW OF ACTIVITIES IN GOVERNMENT"

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"Where is the wisdom we have lost in knowledge.
Where is the knowledge we have lost in information."

T. S. Elliot

TABLE OF CONTENTS

GIS
REVIEW OF ACTIVITIES IN GOVERNMENT

	Page
I. Executive Summary	iii
1. Preface	1
Geographic Information Systems & Information Technology	1
2. Introduction	3
2.1 Importance of Geo-information to the Maritimes	3
2.2 GIS in the Maritimes	4
2.3 Market Potential	7
3. GIS Applications in New Brunswick Government	9
3.1 Types of GIS information in New Brunswick Government	9
3.2 Dept. of Agriculture	11
3.3 Dept. of Justice	13
3.4 Dept. of Municipal Affairs and Environment	14
3.5 Dept. of Natural Resources and Energy	16
3.6 Dept. of Supply and Services	22
3.7 Dept. of Tourism, Recreation and Heritage	23
3.8 Dept. of Commerce and Technology	26
3.9 Dept. of Fisheries and Aquaculture	27
4. Conclusions and Recommendations	30
4.1 Summary Statement	30
4.2 Specific conclusion on Government activities in GIS	32
4.3 Collective departmental concerns re: GIS	33
4.4 Recommendations with rationale	34
APPENDIX 1: Background on related initiatives in GIS and Information Technology	47
APPENDIX 2: Current information related activities in New Brunswick	60
APPENDIX 3: Memorandum of Understanding on GIS	65
GLOSSARY	71

I. EXECUTIVE SUMMARY

1. We are moving from a resource based economy to an information based economy. In this new economy, information is the new capital resource and will be the main capital input leading to growth and development.

2. In this new economy we are seeing the emergence of new computers, new software, new content, new skills, new jobs and new industries.

3. Geographic Information Systems (GIS) technology is a major strength in New Brunswick and the region and offers one of the best economic development opportunities in this new economy.

4. GIS technologies could play two very important roles in our local economy if handled in a timely and rational manner. Firstly, it would allow for more effective decision-making in government by providing better information on our resources (natural and other). Secondly, it would provide opportunities for the private sector to develop a strong information service industry which could eventually develop to serve the international market.

5. The Maritime region and New Brunswick in particular is nationally and internationally recognized for its strength in GIS. This recognition has been earned largely from activities at the Dept. of Surveying Engineering at UNB, the Land Registration and Information Services (LRIS), the N.B. Dept. of Natural Resources & Energy and the Dept. of Municipal Affairs and Environment.

6. Today, graduates and workers from these institutions are managing most of the major GIS systems in industry and government all over Canada.

7. Except for a few private sector enterprises in the region, all GIS type activity is confined to educational institutions and government or quasi-government agencies.

8. In order for this province to take advantage of this economic development opportunity, private sector must be encouraged to adopt this new technology. However, for this to occur, government must be willing to allow private sector to undertake some work that has traditionally been done by government.

9. This government spends an estimated $25 million (1988$) annually on GIS type information (from LANDNET STUDY). Total funding available from the various subagreements under the Canada/New Brunswick Economic and Regional Development Agreement (ERDA) is $305.4 million over a five year period. A significant portion of this funding also results in the acquisition of GIS type information.

10. It was also estimated that annual expenditures in Canada from geographical information related activities are $1.5 billion with the Maritimes accounting for greater than $160 million (Memex, 1987).

11. The value of GIS type information now in storage in the New Brunswick Government is estimated in the billions of dollars. The cost of managing this growing information base is increasing annually. Billions of dollars worth of information on resources and environment may be lost or may be inaccessible in the future if this information is not electronically stored.

12. The major utilities (N.B. Tel, N.B. Power), resource developers (Noranda, Irving), municipalities and Regional Economic Development Commissions are all confronted with the same problem of dealing with vast amounts of information. Some have adopted GIS systems and others are about to do so.

13. Besides having the technical skills to build and manage such GIS systems, New Brunswick has the unique advantage of having two-thirds of its base maps already in a digital form. These digital maps are the base on which all information will be compiled. Some line departments have also developed GIS applications to the state where some of these could be marketed nationally and internationally.

14. Government therefore needs to INVEST in providing the technology to line departments and to the private sector. This INVESTMENT will be costly in the short term but long term benefits will be significant.

15. Of primary importance to this economic development strategy in GIS is the need for broad government support and a well thought out Government Policy on GIS. Development of this Policy is crucial and should be delayed no longer.

16. Recommendations are that:

I A special interdepartmental committee be set up to draft a provincial policy.

II Government establish a Central Surveys and Mapping Agency in either of two line departments (MA&E or DNRE) to facilitate the orderly development of GIS in government and to support the growth of private sector capabilities in GIS.

III Line departments include in all sub-agreement activities the reservation of funding for the cost of infrastructure and curatorial service of information gathered under these programs.

IV Government pursue the development of a new Sub-agreement with the Federal Government which would specifically address the theme of Information and Communications.

V Government expedite the funding of applications development in GIS through the several subagreements.

VI Government investigate opportunities for joint funding of applications development under the recently signed Memorandum of Understanding on GIS between the Federal Government and the Province.

VII Government support the development of a Manual of Standards in GIS which would then be adopted by all line departments and agencies working on behalf of the Crown.

VIII Government investigate the concept of a Central Information Bureau for government generated GIS information. This Bureau could be either in government or managed by the private sector on behalf of the Crown.

IX All line departments seek opportunities to contract out to the private sector some of the GIS related activities normally undertaken in-house.

X Government encourage joint research and development activities with the University of New Brunswick (UNB) and the private sector. Such activities should include exchanging information and expertise (including personnel) with each other.

XI Government continue its support for the creation of a Centre of Excellence in GIS at the University of New Brunswick and work with the Federal Government to bring it about.

1. PREFACE

GEOGRAPHIC INFORMATION SYSTEMS (GIS) & INFORMATION TECHNOLOGY

GIS can be defined as a state of the art, Information Age tool. This technology is used in developing, managing, distributing, using and sharing spatial information which describes the natural environment, the man-made environment and socioeconomic conditions.

Increased activity in GIS is fueled by:

(i) Need to know

Information in its many forms is the raw material of the new economy. Information is central to manufacturing, services, and the operations of government. The activities of inquiring, communicating, evaluating, and deciding have become predominant. In industry, the "need to know" fuels the search for information on which business decisions are based.

(ii) Technological Change

Better and cheaper computers and software are rapidly replacing traditional manual methods of organizing and using information. This new technology is making management of vast amounts of data much easier.

(iii) Industry

Recent studies by the Federal Government show that information industries will contribute the major part of the future gross national product. Goods will be sold as part of a total information package.

Information technologies are leading to the "commoditization" of content. Content will more and more become an article of commerce. Content refers to the vast range of ideas, experieinces, concepts, reports, directions and recipes produced by a society.

GIS Information Technologies can consume vast amounts of time, management attention, and money, even when applied properly. Getting it right requires the best co-operative efforts of the business planner and the information technologist to generate ideas and to instill the appropriate measure of reality.

2. INTRODUCTION

2.1 THE IMPORTANCE OF GEOGRAPHICALLY REFERENCED INFORMATION TO THE MARITIMES

The economy of the Maritimes is heavily reliant on its natural resources of the land and sea. Our ability to optimize the exploitation of these resources is directly linked to the information we have on them. It is thus a matter of survival for us to efficiently process and interpret this information in order to better manage these resources. The maritime leadership in the high technology field of geographic information systems, therefore, has been no accident. Only to the extent that the region can properly manage its geographic information can it properly manage its natural resources and environment. Maritime leadership in geographic information systems has evolved in response to this significant local need.

The development of our capabilities in geographic information technologies will provide us additional benefits as well, in terms of creating a viable service industry in geographic information. The region, being a small jurisdiction, is representative of many small countries and of many state, county and municipal environments in the United States. Our unique mix of land and sea resources also parallels those of many third world countries. These facts bode well for export trade in such a service.

Although we have most of the ingredients to develop an industry related to Geographic Information Systems, we do not have the mechanisms to marshall the resources, identify [illegible] strategic endeavours, and to coordinate activities and projects which support a multi-year strategy to put in place the capacity to produce and deliver services and products to users, to government and ultimately to the world market. Thus the need was identified for the establishment of a geographical information technology consortum in the region.

The Government of New Brunswick, recognizing the development opportunity presented by GIS technologies have embarked on a strategy to bring all the resources in the region to work together to capitalize on this proven area of Maritime excellence. Through these efforts, the Champlain Institute (CI) has been created to provide a partnership forum for users, developers and industry to develop a Maritime industry in geographic information technologies.

2.2 GIS IN THE MARITIMES

Advances in hardware, software and telecommunications technologies are having a profound impact on how land and water-related information is collected and managed. Geographic Information Systems are now being implemented and proven across Atlantic Canada in a wide range of applications including forest management, municipal facilities management, mining and exploration, agricultural planning, topographic mapping and nautical chart production.

In the last 20 years, the Maritime Provinces have become acknowledged world leaders in the application of land-related information to produce a broad set of information products for sale to both government and the general public. In addition to the provision of land and property information, there are a number of initiatives

currently underway in the Region which make use of computers to integrate geographically-related information dealing with forestry, mining, agriculture, the coastal land/sea environment and municipal services.

This work has been accomplished by provincial and regional agencies, the University of New Brunswick and a few private sector firms working individually within very limited budget constraints. For this reason, it has proceeded at a very slow pace. All the same, the information and technology management experience gained through many of these pioneering efforts has been recognized around the world. In the past two years alone, UNB and LRIS have provided GIS-related consulting services to groups in Australia, Zimbabwe and Barbados. Also, software and systems developed in the Maritimes are being adopted for use by foreign governments such as Holland, Egypt and Australia.

As a result of its GIS-related activities, the Maritimes have developed an impressive array of world class institutions in the geographically referenced information systems field. These institutions are clustered in three areas: government agencies and departments, educational institutions, and private sector companies. However, because of the depletion of funding, the lack of adequate government support, and the disillusionment of the intellectual infrastructure, the leadership earned over the last 20 years is gradually eroding. While these institutions have not yet come together as a cohesive integrated whole, there is a growing resolve to increase cooperation and work toward common goals and objectives.

It is clear that institutions in the Maritimes have the competence and stature to be very competitive in the geographically referenced information systems business. At the local level, this means that the region will not have to import, to any large extent, the goods, services and expertise required to better manage its natural resources, environment and socioeconomic development. It also means that with the assistance of a federal-provincial commitment and front-end federal-provincial funding, the region is poised to capture a good share of the international market for GIS related goods, services and expertise.

Since large multinational companies and foreign governments also realize that a significant international market for GIS related products and services now exists, the Maritimes and Canada must move quickly and decisively if they are to participate in an industry they helped to foster. This industry would also engage in a very large export trade in goods, services and intellectual property developed by the new industry in the course of its support of regional needs. The alternative is to miss a window of opportunity and to let others take the lead. Canada would become a net importer of geographic information systems as our technology base and expertise wither for lack of an aggressive strategic development program.

2.3 MARKET POTENTIAL *

The Major Surveys Study Team of the Task Force on Program Review reported that the Government of Canada spent $550 million in 1985 to gather, process and disseminate natural resources and environmental information and another $200 million for socioeconomic information.

Another study, conducted for the Department of Regional Industrial Expansion (DRIE) by the Task Force on the Surveying and Mapping Industry in Canada, estimated in 1985 that private sector companies in this field employed 9000 persons and had total annual sales of $340 million, of which $60 million was from export trade. This task force estimated that revenues were $20 million from the federal government, $55 million from provincial governments, $41 million from municipalities and $164 million from the domestic private sector. It was thus estimated that annual expenditures in Canada from geographical information related activities are $1.5 billion with the Maritimes accounting for greater than $160 million.

No observers expect these levels of expenditures to decrease over time. In fact they see significant growth as the new technology provides more new geo-referenced information products, more flexibility in their use and more accessibility to a wider range of users.

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* (From "Geographical Information Systems in the Maritimes and the Potential for Regional Economic Development". Prepared by Memex Information Technologies (Nov. 1987) for the Department of Communications, Government of Canada).

For example, all municipalities are faced with a spatial information management program of tremendous proportions. Practically all information on the urban infrastructure - roads, sewers, utilities, services, etc. - is now in the form of paper drawings and supporting documentation. Even where it is in computer form, the information cannot be related to other components of the overall infrastructure. This means that over the next years all of the information currently on paper must be converted to computer-readable form.

R. L. Simpson, Executive Director of the Council of Maritime Premiers' Land Registration and Information Service, reported to the Council that between now and the year 2000, the world-wide market for converting governments' existing hard copy maps, charts and engineering drawings to computer readable form is estimated at $90 billion. No one close to the subject would argue that the figure is less.

3. GIS APPLICATIONS IN NEW BRUNSWICK GOVERNMENT

3.1 TYPES OF GIS INFORMATION IN N.B. GOVERNMENT

Nearly all government departments, in some form or the other, collect, process and use geographically referenced information. Most of the applications identified in a recent survey undertaken by the Science and Technology Secretariat are specific to a particular process or function within each department. The data bases within government (manual or electronic) are mostly independent with little or no linkage to other data bases. Many of these data bases would be of potential benefit to the private sector if they were made more accessible. There is also much duplication. This is particularly true for most manual systems because of the difficulty of monitoring such systems. Another major reason for duplication is that no single person or group knows the true extent of these data bases, where they are and what they contain.

In general, there are seven types of geographically referenced information data sets in government, most being of a "textual" form rather than in a "graphic" form. Each type, depending on its use, varies in its degree of sophistication vis-à-vis its spatial attributes. These seven types of information are related to:

(i) Finances (re: Budgets, Loans, Grants, Firms, Contracts)
Common to all departments. Particularly intensive in the Department of Commerce & Technology. This data type is rather sensitive because of confidential information contained.

(ii) Personnel (All Departments)

Located by addresses.

(iii) Physical Resources (re: roads, utilities, bridges, building)

Common to all departments. Particularly intensive in the Departments of Transportation, Natural Resources & Energy, Supply & Services.

(iv) Natural Resources and Environment (re: forest cover, mining, water, fisheries, lands)

Particularly intensive in Departments of Natural Resources & Energy, Municipal Affairs & Environment and Agriculture.

(v) Human Resources (re: demographics, education, welfare, crime, health)

Particularly intensive in Departments of Health, Education and Labour.

(vi) Legal (re: lands, properties, ownership, grants, deeds)

In all departments. Particularly intensive in Departments of Justice, Natural Resources & Energy, and Municipal Affairs & Environment.

(vii) Industrial (re: output, shipments-origin & destination, productivity).

In all economic development related departments.

Practically all the data presently contain some geographic elements such as addresses, counties and map numbers and, therefore, could be indexed and accessed by appropriate computer systems.

Conversion of all this information to an electronic form would obviously be cumbersome, expensive and undesirable at this time. However, all this information is presently within government and each data base is growing annually. The decision to convert this information to an electronic form would be based on priorities determined by each line department. The extent to which conversion should be undertaken would also be determined in the same manner.

Management of geographically referenced information in government is therefore of concern to all departments and should be addressed as soon as possible. Many departments are increasingly becoming aware of the potential for problems if the situation continues indefinitely. Some of the more affected departments such as DNRE&E, Transportation, MA&E and Agriculture are taking steps to remedy their own individual problem. There has been some success, but all these departments see the need for a more coordinated approach to a problem that is pervasive through government.

A breakdown of geographically referenced applications within a selected number of government departments follows:

3.2 Department of Agriculture

The Department of Agriculture spent approximately 3.25% of its Provincial 1986-87 budget ($646,000) in compiling and processing geographically related information. In general, automated handling of GIS related information is limited to the Land Resource Section in the Plant Industry Branch. This Branch owns a GIS system "CARIS" which was bought with Sub-agreement assistance.

However, because of the nature of the activities of this Department, it collects and processes a vast amount of information that is crop, land, farm and environment related. As an example of its

involvement, this department spent $1,543,000 in natural science activities in 1986-87 and an estimated $1.6M in 1987-88.

In addition, the department is also spending under the ERDA the following:

$32,000,000 - Agri-Food Subsidiary Agreement

$13,125,000 - Livestock Feed Subsidiary Agreement

In essence, therefore, at the termination of this agreement, this Department would have spent in excess of $50 million in gathering information on land and crop improvement, much of which is geographically related. In consideration of past agreements and provincial spending, this department would have information on projects worth in excess of $0.5 billion (1988$). It is very difficult to determine what amount of this information is retrievable. In the present greement, no funding has been provided for curatorial services for the information presently being compiled.

The Department is also cooperating with the Dept. of Surveying Engineering at UNB in research into the applications of GIS to soil erosion and conservation problems. This effort could be expanded should proposals be successful for the development of a national Centre of Excellence in GIS at UNB and for a National Soil Accord now under negotiation between the provinces and the Federal Government.

The Department recognizes the need for better management of its information and is presently conducting an internal study to establish its priorities.

Areas in which applications are developed are:

(i) On-farm soil survey maps

(ii) Regional soil survey maps

(iii) Livestock Feed Initiative (Fed/Prov Agreement)

(iv) FLIP data base (Farm Land Identification Program)

Present Concerns re: GIS

(i) Need for Provincial policy and direction on GIS

(ii) Need for funding for development of applications

(iii) Need for standardization

(iv) Need for central location for access to government information.

3.3 Department of Justice

This department is intensively involved in managing information on land ownership. Most of this activity occurs in the Land Registry and Land Titles Branch. This branch manages all provincial data out of fifteen offices and is actively involved in the process of transferring land. Contained in the fifteen offices are all subdivision plans and some survey plans. This information, dating back to 1784, is handled through card indexes, microfilm and hard copy maps. Manpower to manage this information base is in the vicinity of sixty-five including Registrars, Deputy Registrars and Lawyers. The department spends approximately $1.8 million annually to perform this function.

Computers are just starting to play a role in assisting in the management of this database. The Department presently has one IBM-PC and a MicroVax II dedicated to this task.

The Department is presently developing the L.O.I.S. (Land Ownership Information System) data base with the assistance of LRIS (Land Registration and Information Services). This data base is vital to development activities involving land. Data is being compiled on the Mircro Vax system. Application software are being developed to meet the needs of the Branch.

Present Concern re: GIS

(i) The need for land related systems standards.

3.4 Department of Municipal Affairs and Environment

All Branches in this department to some extent gather and process GIS related information. However, two branches are heavily involved and expend considerable portions of their budgets on this activity.

3.4.1 Assessment Branch

Approximately 85% of this branch's activities relate to the management of Assessment and Registry Data which includes 360,000 Property Accounts, with up to 76 record types and up to 500 individual fields of data for each property. Application are in the areas of:

(i) Assessment & Tax Data

(ii) Registry Data

(iii) LRIS Data.

Branch concerns re: GIS

(i) The management of information as a resource. (Users, compilers, distributors and their respective roles).

(ii) Will the need to automate detract from the need to gather information and will this mean a redistribution of funding?

3.4.2 Water Resource Planning Branch

This Branch expends 60% of its effort to GIS related activities specifically in hydrology, watershed studies, hydrogeologic studies, resource mapping, recording of claims, licenses and leases and in maintaining data bases on wells. This Branch also spends 8% of its effort on hydrologic work financed under the Canada/New Brunswick Flood Damage Reduction Programs and the Agreement Respecting Water Quantity Surveys.

It manages over 1200 megabytes of hydrological and climatological data. It also uses over 100 different topological maps, 170 flood risk maps, 75 geologic and hydrologic maps and many charts and graphs - all of which are in hard copy format. The biggest challenge is the upkeep of this data base in terms of continuous updates and revisions. Areas in which applications are developed are:

(i) Flood plain building elevations

(ii) Water well log data

(iii) Observation well data base

(iv) Climatological data types

(v) Municipal water quality information

(vi) Watercourse alteration projects

(vii) List of well drillers

(viii) Water shed maps

(ix) Municipal infrastructure data base

These data bases and systems are resident on mainframe and mini computer systems. Some other data sets are still only partially in a computer compatible form. The Branch

has identified a need for a more suitable system and its work would benefit greatly from the adaption of a GIS system such as CARIS.

Concerns re: GIS

(i) Wish to develop in-house capability to do thematic mapping.

(ii) To also develop software models to simulate flood conditions which would aid flood forecasting.

(iii) Need for a GIS is particularly critical in the hydrogeological studies made by the Branch.

(iv) This Branch needs easy access to Mineral Resources Branch's information.

3.5 Department of Natural Resources & Energy

This department is undoubtedly the most involved in GIS related activities and is the most advanced in terms of adopting the technology. The Timber Management Branch has received international attention for its efforts in developing its forest cover mapping capability. This department's efforts in GIS, however, have been to a great extent confined to forest applications. Until recently, very little attention had been paid to the mining, lands and energy sections. There is, therefore, considerably more potential for use of this technology in this department.

Based on past expenditures in the natural sciences, DNRE&E has a major task in being able to fully manage its vast volumes of information. As an example, in fiscal year 1986-1987, this department spent approximately $5.8 million (12% of its provincial budget) on

activities related to the natural sciences, over 90% of which is geographically related. In addition to provincial spending, DNRE&E is presently carrying out major exploration, mapping and management programs out of two separate Federal/Provincial Subagreements. The Forest Renewal Program provides $77.4 million and the Mineral Development Subagreement another $22.3 million. Again, activities under these subagreements will provide large volumes of GIS related information which will require storage and upkeep.

This department also receives information from the private sector and is responsible for the care and maintenance of such records. As an example, the Minerals Division receives several million dollars worth of exploration assessment reports annually.

Estimates have shown that the value of recorded assessment data from exploration and mining companies since 1958 exceed $300,000,000 representing approximately 40% of actual work done in the province in this time. This department also maintains vast data bases on animal habitat, lands, properties and geoscience. Many of these data bases are still manual and those that are electronic may not be accessible by others.

The following is a break down of activities by Branch responding to the survey:

3.5.1 Timber Management Branch

This Branch is the most advanced GIS user in government with 100% of its activities directed at GIS related activities.

It presently manages 1.5 gigabytes of resource data covering 1980 maps on a PRIME 550-11 and a PRIME 2250 minicomputer. The operating systems are the ARC/INFO GIS and the PRIMOS.

The branches applications are developed in forest resource management activities such as:

-Harvest scheduling

-Land use

-Insect and disease control

-Silviculture

-Fire protection.

The following software packages developed by the Branch are available to private sector:

1. Wood supply model
2. Harvest schedule model
3. Tape library management system.

3.5.2 Geological Surveys

100% of this branch's activities are in the natural sciences and include exploration, mapping and curatorial services for maps, cores and records. The branch spends an average of $5 million annually on these activities financed jointly with the Federal government through a subagreement on mineral development.

It maintains libraries containing thousands of geological, geochemical and geophysical maps. It also maintains three core libraries at Fredericton, Sussex and Bathurst. These core libraries contain diamond drill cores that are in effect worth billions of dollars of effort by government and the private sector.

The branch presently does not have a GIS system and relies heavily on microcomputers. It has no graphic image

capability for maps and relies heavily on paper copies which is very inefficient. It maintains several data bases, some of which are electronic.

The GIS applications in the branch are of a textual nature and are mostly based on small personal computers operating on simple disc operating systems. Some applications are:

- Core Library catalogs
- Drill hole catalog
- Claims, licenses catalogs
- Geochemical data catalog.

Concerns re: GIS

(i) the Branch is in dire need of a GIS system.

(ii) it would like to have all its base maps in a digital format.

(iii) The need for compilation and communication standards applied to government and the private sector to facilitate exchange of information.

(iv) That available GIS data bases and software should be utilized and not duplicated by other departments.

(v) The need to identify government and private sector agencies responsible for different GIS information themes.

3.5.3. Crown Lands

100% of this branch's activities are directed at maintaining records of crown lands and provincially owned properties. Crown lands make up approximately 46% of the province hence

the task of maintaining these records is enormous since some of the records and maps date back two hundred years.

In addition to maintaining crown land records, the branch maintains a computer file of 20,000 parcels of provincial properties, manages over 2000 sepia (transparent film) maps, 5000 maps on microfilm and paper plus computer output microfilms of listings of over 350,000 parcels of land as compiled by LRIS. Activities are such that this branch wishes to convert all maps and files to a GIS system.

Applications in this branch are confined to the management of Crown Lands. The branch presently stores its electronic files on the Sperry Univac mainframe at Marysville Place and accesses the information remotely by terminal and printer.

Information available to the public and private sectors includes:

- Crown grants and surveys
- Provincial property boundaries
- Camp sites
- Land leases.

<u>Concerns of the Branch re: GIS</u>

It would like to see:

(i) Development of a Departmental GIS network (Branches and Regions)

(ii) Policy developed in government to facilitate coordination, cooperation and communication in GIS activities.

(iii) Standards be developed and maintained.

(iv) Development of digital capability to address departmental needs in thematic mapping.

(v) Digital data bases completed for base and property mapping.

3.5.4 Departmental Support Services (Information Systems Section)

Activities of this section have until recently been confined to providing branch support in general information processing and systems support. It does not by itself generate any GIS related information. In recent years it has been providing some GIS related products to branches within the department. Applications are related to the development of some map overlays for the regional offices and some branches within the department. They include maps showing:

- License boundaries
- Electoral districts
- Fish barrier sites
- Leased water boundaries.

The Section does not own a GIS system but operates with a SPERRY Micro IT using Versa CAD/Versa data.

Concerns of Branch re: GIS

(i) Wishes to see a common departmental approach and direction to GIS.

(ii) Common standards applied to all GIS data in government.

(iii) The need for common digital base maps.

3.6 Department of Supply & Services

The main user of geographic information within the department is the Properties Branch within the Buildings Division. This branch currently spends approximately $138,000 per annum to gather, process and manage geographic information, of which the major expenditure is for property surveys.

This unit is currently developing a micro-based provincial properties database system. The actual development work on this system is being carried out by the Information Systems Division of the Department.

The Properties Branch manages a data base consisting of 1400 properties administered by the department. It also works with 5000 microfiche LRIS property maps and alpha-numeric listings; 1000 LRIS and NTS maps; 1000 land surveys and 200 aerial photographs. The Branch's applications are in development, research and property management.

As the major supplier of information systems services for the New Brunswick government, the Department of Supply and Services is interested in participating in any future GIS initiatives.

Their experience in systems development, project management as well as their technical expertise in the application and management of computer and telecommunications equipment would be of value in the development of a unified system for the government.

Concerns re: GIS

(i) Ownership and responsibility for keeping information current.

(ii) Information security.

(iii) Inventory of information data bases to be maintained and made available to the public.

(iv) Intersystem connectivity and transferability for automated systems.

3.7 Department of Tourism, Recreation & Heritage

The department's involvement in geographic information is mainly centered around three branches, namely; Field Services, Archaeology and Historical Sites. However, most of the other branches recognize the usefulness of GIS and hope to take advantage of the technology as soon as it becomes available to the department. As a result of the interest demonstrated throughout the department, a conscious effort is being made by management to address the problem. This department maintains very close contact with the GIS community through their representation on the provincial Surveys and Mapping Committee.

A breakdown of activities in the Department is as follows:

3.7.1 Field Services Branch

100% of this branch's activities are geared at gathering, processing and managing GIS type related information. In the branch's files are over 3000 map sheets containing land related information pertaining to Tourism, Recreation and Heritage. In addition, it has over 1000 microfiche cards of data and five megabytes in computer storage.

This branch would like to have the capability of electronically linking with LRIS, DNRE&E and MA&E and to be able to access their databases.

3.7.2 Archaeology Branch

Activities of this branch are more site specific and include detailed ground surveying and mapping. The 3-Dimensional capability of a GIS system would be of value in site descriptions and interpretation. This branch presently does some resource mapping and utilizes base maps prepared by DNRE&E and LRIS.

3.7.3 Parks and Historical Sites (District 6)

Activities related to the operation of Parks and Historical Sites. This branch utilizes base maps provided by DNRE&E and LRIS and maintains twenty-five detailed maps of parks and sites. It does not anticipate owning a GIS system but would like to access a common system when available to the department.

3.7.4 Recreation Branch

This branch has some involvement in GIS mainly through the production of six canoe maps and two orienteering maps. It does not have any hardware and will not pursue any such acquisitions. (One person involved part-time).

3.7.5 Advertising and Communications Branch

Its involvement in GIS centres around the production of the Tourist Highway Map (approximately 375,000 annually at an approximate cost of $95,000). (Two people involved in different aspects).

3.7.6 Policy Planning Branch

Its involvement is centered around statistical information. The branch has expressed a desire to have the ability of mapping this information.

3.7.7 Community and Regional Development Branch

Reported no involvement in GIS.

3.7.8 Information Services Branch

The only involvement reported by this branch was around the dispensing of the Tourist Highway Map which is done in conjunction with the Advertising and Communications Branch. (One person involved).

3.7.9 Sports Branch

Reported no involvement.

3.7.10 Village Acadian

Reported storage of one hundred maps on site related to Village operation. No hardware or software.

3.7.11 Tourism District Numbers 1, 4, 5 & 6

Reported only involvement in storage of plans and maps dispersed from Headquarters.

3.7.12 Business Services Branch

The branch reported that it is interested in the GIS concept, but is presently not involved to any great extent. It has some hardware and software in use related to their programs.

Concerns re: GIS

(i) That all departments receive coordination from a central source in regards to establishing formats for information gathering.

(ii) That direction be received from an office of high authority to implement a government wide GIS and to facilitate the appropriation of funds for such activity.

(iii) The problem of security and verification of information should be addressed in a centralized system.

(iv) That private sector be a partner in the development and running of such a system.

3.8 Department of Commerce & Technology

The Department of Commerce & Technology currently uses and generates two main types of geographically based information; on assistance to firms and on manufacturers and processors in general. The information on firms assisted is used principally by Administration, Planning & Agreements and Regional Development & Small Business although in the first two cases it is often being manipulated and analyzed for other parties. This information is generally required on Regional Economic Development Commissions boundaries or electoral districts. The information on manufacturers in general comes from an annual survey by Administration and is published by county but is most often used by a number of divisions within C&T by R.E.D.C. boundaries.

Potential Use

Trade related data, the third most used type within the Department, should see a rapidly growing use especially in light of free trade developments. In this instance the data will not be so much sub-provincial as interprovincial and international.

Departmental Concerns re: GIS

The three main concerns are the standard ones of duplication, compatibility and confidentiality. Duplication most often results from lack of knowledge of or inability to access data maintained by others. Work on a central data-base or a data base directory would help. Compatibility of data is a major problem and would require recoding to a standard detailed set of identifiers. The concerns for confidentiality of informtion must be respected yet balanced against the need for people to have access to information.

3.9 Department of Fisheries and Aquaculture

The department generates or gathers large volumes of information which could be referenced geographically.

Principal data bases include:

(1) Loan and interest program information managed by the Fisheries Development Division;

(2) Fishstock management plans and related data managed by the Resource Policy and Planning Division;

(3) Information on licenses under the Fish Inspection Act and the Fish Processing Act managed by the Operations and Services Division;

(4) Information on aquaculture site development and financial assistance managed by the Operations and Services Division;

(5) The extensive banks of socioeconomic and marketing data, maintained by the Statistics and Market Intelligence Branch, including data collected from external sources;

(6) The Finance and Administration division's storehouse of information on budgeting, personnel, expenditures, regional operations, assets, etc.

(7) The regional offices and establishments which handle extensive volumes of data.

Handling Costs

Handling costs for the department in total includes 16 to 20 persons on an annual basis plus about $80,000 in annual expenditures. Handling refers to the collecting, storing, processing, distribution and displaying of the data.

Computer Technology

Computer hardware owned by the department includes an IBM 36 with 13 terminals for word processing plus 7 terminals for data collection and other uses. There are 3 personal computers in head office and 4 personal computers in the regions.

Software includes COBOL for the loan program, QUERY 36 and DISPLAY WRITE 36.

The Divisions of Finance and Administration and Fisheries Development make the most use of computer technology for geo-data handling.

Concerns and Priorities

The Department intends to examine fully the possibilities for developing a computerized GIS network which would link its data bases together. A study will also be conducted to find ways of sharing and accessing data with other departments.

The Department is very much dependent on outside expertise, support services and funding to develop and implement a system best-suited to meeting departmental objectives.

The Department is prepared to work closely with other departments to develop standards and norms. Duplication should be avoided and information shared.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 SUMMARY STATEMENT

It is clear that information and communications technologies are having a profound impact on the way we live. Further, we live in a resource based economy and are confronted with the stark realization that our resource base is dwindling at an alarming rate. Our ability to optimize these dwindling resources of the land and sea is dependent on our commitment to understand more of our environment and to be able to predict with a greater degree of confidence those parameters affecting these resources. Technology has provided us the tools to gather and process more information, and today, we are better able to make decisions as to the utilization of these resources. We are, however, a far way from reaching full competency in the utilization of this new technology and we must commit, in the short term, a significant portion of our assets to "tool up" in government, to support private sector initiatives and to develop a viable information service industry.

The Maritime lead in geo-information technologies has therefore come from our desire for better tools and better information. We have achieved both national and international recognition for our efforts and continue to set the pace for others to follow. The Federal government recognizes these activities and has endorsed our efforts to continue. This can be reflected from the host of initiatives in the region for which the Federal Government is seeking active participation.

Critical to our growth in this area, is private sector's ability in becoming active partners with government. Historically, governments of the region have been the major compilers and users of geographically referenced information while the private sector confined its activities to traditional fields of work. Information, however, has become a "commodity of trade" and private sector is actively looking to government to undertake certain aspects of information compilation, processing and dissemination which have traditionally been the responsibility of government. The opportunity exists for government to divest itself of some of these tasks.

Government growth in the last decade has partly been attributed to the need for compiling and processing more information. The ERDA sub-agreements have contributed significantly to this growth and many sub-agreement employees were retained to continue in projects started under these sub-agreements.

Government is also faced with the realization of an aging staff and a very slow turn over rate of personnel into the private sector. The next two decades will see a significant rate of retirement of staff which in part would need to be refilled. Retooling and the adoption of information technologies today will minimize this impact by creating a more efficient work force. Private sector's ability to also undertake some of the traditional work in government will further contribute to a more lean and efficient civil service. This partnership will also allow private sector to develop exportable skills which can be sold to countries in the developing world.

4.2 SPECIFIC CONCLUSIONS ON GOVERNMENT ACTIVITIES IN GIS

A review of G.I.S. activities in several line departments of the government quickly points to the fact that this government is expending considerable resources in both money and people on the collection, storage and dissemination of geographically referenced information. The Office of Government Reform study of August, 1985, estimated that this government spends approximately $23 million per year on such activities. A conservative estimate of the value of information stored in various departments exceeds $5 billion and this government is compiling new information at the rate of over $23 million per year.

A significant amount of geographically referenced information is also being acquired under the ERDA Subsidiary Agreements. Under the present ERDA Agreement a total of $304,502,000 will be spent in New Brunswick over a five year period. The biggest expenditures will be in the resource sectors which are the primary generators of geographically referenced information. It is interesting to note that no where under any of the individual sub-agreements has the matter of curatorial service and storage of information been specifically addressed.

While information gathered under past sub-agreements may be available, most researchers are of the opinion that because of the sheer volume, inaccessibility has become a major problem. In many cases, information that is available is overlooked and regathered. Also, line departments are finding it more difficult to access needed information from other line departments because of the lack of proper government wide data-base directories.

Information overload has also now become a very common problem in all line departments. We are now less capable of interpreting the vast volumes of data available to us and as a result more and more disinformation reaches decision makers. Part of the problem has to do with technology or the lack thereof.

Line departments dealing with water and land resources including DNRE&E, MA&E and Agriculture have for many years identified the "information overload" problem. These line departments have taken steps to "tool up" to handle their own specific needs. Other line departments are following this lead and have begun to acquire computer systems and software. In so doing, all these departments have recognized major problems which need to be looked at collectively or corporately by this government in order to minimize cost and to maximize the benefits to the government and to the private sector.

4.3 COLLECTIVE DEPARTMENTAL CONCERNS RE: GIS

Based on the survey of selected line departments and numerous discussions with resource managers and research staff within government, some very common concerns on GIS have been brought forward. These concerns can be summarized as NEEDS which must be addressed by government. They are as follows:

(i) Need for a Provincial policy and direction on GIS.

(ii) Need for a central authority within government to coordinate activities and to focus efforts on GIS.

(iii) Need for funding for infrastructure.

(iv) Need for funding for applications development.

(v) Need for standardization of information data bases, hardware and communication protocols.

(vi) Need for a central location (or brokerage) for access to government information.

(vii) Need for partnership with the private sector and the transfer of technology and expertise.

(viii) Need for support for research and development.

4.4 RECOMMENDATIONS WITH RATIONALE

The following recommendations are based on addressing the above NEEDS which have been identified as major constraints in the adoption of GIS in government and also in the development of a viable private sector service capability.

(i) Provincial Policy

IT IS RECOMMENDED THAT A SPECIAL INTERDEPARTMENTAL COMMITTEE BE SET UP TO DRAFT A PROVINCIAL POLICY ON GIS.

This policy must address the importance of information in government and government's commitment to its continued acquisition, integrity, safeguard and safe disposition. Quality and accessibility will be two crucial elements addressed by the policy.

Because of the clearly defined mandates of several line departments and the diversity of GIS type information in government, representation on this policy committee should be made up of resource managers and policy and planning analysts of government.

This policy should also address the question of private sector development opportunities with government, in particular with regards to the following:

(i) assisting private industry in the development and implementation of a domestic and overseas marketing strategy for GIS and related products;

(ii) exchanging information and expertise (including personnel) with each other;

(iii) making government facilities and equipment available for development projects;

(iv) entering into joint ventures, shared-cost arrangements and contracts as opportunities occur, and;

(v) encouraging and co-ordinating the development of common GIS standards.

(ii) Central Authority on GIS in Government

IT IS RECOMMENDED THAT THIS GOVERNMENT ESTABLISH A CENTRAL SURVEYS AND MAPPING AGENCY IN EITHER OF TWO LINE DEPARTMENTS (MA&E OR DNRE) TO FACILITATE THE ORDERLY DEVELOPMENT OF GIS IN GOVERNMENT AND TO SUPPORT THE GROWTH OF PRIVATE SECTOR CAPABILITIES IN GIS.

It is the consensus of resource managers and researchers in government and also of private sector developers of GIS technology and services in New Brunswick that the interest of GIS is best served in government through a Central Surveys and Mapping Agency.

Results of this investigation support this consensus and recommends that the Central Surveys and Mapping Agency be established working closely with the Corporate Information Resource Office (CIRO). This agency could be established either in or in affiliation with DNRE or MA&E.

Based on recommendations coming out the New Brunswick Government Technology Strategy (DMR Group, 1987), the position of Chief Information Resource Officer (CIRO) has been planned for placement in Cabinet Secretariat. This appointment will be at the Assistant Deputy Minister level, allowing it the right profile for such an important initiative in government.

(iii) Need for funding for infrastructure

IT IS RECOMMENDED THAT:

1. *ALL LINE DEPARTMENTS INCLUDE IN ALL SUB-AGREEMENT ACTIVITIES THE RESERVATION OF FUNDING FOR THE COST OF INFRASTRUCTURE AND CURATORIAL SERVICE OF INFORMATION GATHERED UNDER THESE PROGRAMS.*
2. *THIS GOVERNMENT PURSUE THE DEVELOPMENT OF A NEW SUB-AGREEMENT WITH THE FEDERAL GOVERNMENT WHICH WOULD SPECIFICALLY ADDRESS THE THEME OF INFORMATION AND COMMUNICATIONS.*

Government can no longer afford to neglect the need for providing the basic building block on which future decisions will ultimately rely.

In this information age computers are a prerequisite, however, infrastructure is much broader and includes the more costly elements of data base compilation and networking.

This country has grown on elementary infrastructures which included the building of the national railway, the St. Lawrence seaway, the Trans-Canada highway and the national air-carrier. Today, we move into a new era, the "Information Age" which requires in like, a different but never-the-less similar basic infrastructure, the building of networks and linkages for the "transportation" and "shipment" of a new commodity "information".

Government, therefore, needs to look at this requirement for infrastructure in a similar light as it would view the building of a "highway". In such an undertaking, the government looks at private sector to provide the workforce, equipment and materials through contractual obligations. Such arrangements have led to the development of private sector capabilities which have matured to be reliable and efficient. Some of these companies have eventually grown to provide expertise to the international market.

INVESTMENT in information infrastructure by government, can be made to provide similar benefits to the private sector while still achieving the primary objective. The private sector can be made to provide the hardware, software and service for the building and maintenance of a significant portion of the network and all data bases required by government. Eventually, private sector expertise would develop to service both domestic and international markets.

The purchase of infrastructure must be viewed by government as an INVESTMENT in the future. Such purchases can be accommodated gradually over time through fiscal management both at the government and departmental levels. Already, this is taking place, however, because of the lack of a provincial policy on private sector participation and the adoption of indigenous technologies, some of the economic benefits which could be accrued to the province are lost to foreign competition.

Infrastructure costs could also be accommodated through the various sub-agreement programs presently available to line departments. This opportunity to build on infrastructure has been grossly neglected.

It is thus recommended that line departments include in all sub-agreement activities the reservation of funding for the cost of infrastructure and curatorial service of information gathered under these programs.

It is also recommended that this government pursue the development of a new Subagreement with the Federal Government which would specifically address the theme of Information and Communications.

Such an "Information-Communications Subagreement" would allow the joint-funding for the building of networks and data bases and could also be used to assist the development of the private sector. The Memorandum of Understanding on GIS signed on June 6, 1988, between the

Minister of Commerce and Technology and the Federal Government (EMR) can be used as the foundation for discussions on such a future Subagreement.

(iv) Need for funding for applications development

IT IS RECOMMENDED THAT:

(1) GOVERNMENT EXPEDITE THE FUNDING OF APPLICATIONS DEVELOPMENT IN GIS THROUGH THE SEVERAL SUB-AGREEMENTS.

(2) GOVERNMENT INVESTIGATE OPPORTUNITIES FOR JOINT FUNDING UNDER THE RECENTLY SIGNED MEMORANDUM OR UNDERSTANDING ON GIS BETWEEN THE FEDERAL GOVERNMENT AND THE PROVINCE.

The need for funding for infrastructure is as important as the need for applications development. The two are intertwined as applications development requires an infrastructural base. Already, the lack of infrastructure has begun to hurt applications development in the province. A Memorandum of Understanding on applications of Remote Sensing between the Federal Government and the Province of New Brunswick has failed to materialize because of the lack of remote sensing infrastructure in the province.

Applications development is also a vital tool for manufacturers of GIS software and systems. Without proven applications, systems and software cannot be adequately demonstrated to potential purchasers. The lack of funding for applications development at Universal Systems Ltd., the University of New Brunswick and LRIS is a major stumbling block and is contributing to the erosion of our once established superiority in this field.

It is thus recommended that this government support such activities out of present sub-agreements. Government is also encouraged to utilize the Memorandum of Understanding on GIS with the Federal Government in developing cost shared projects and to direct funding assistance to the Champlain Institute and the private sector.

Applications development could also be expedited through the several sub-agreements within individual line departments. The Department of Natural Resources and Energy is actively pursuing this avenue and other line departments are encouraged to follow this lead.

(v) Need for standards

IT IS RECOMMENDED THAT THE GOVERNMENT SUPPORT THE DEVELOPMENT OF A MANUAL OF STANDARDS IN GIS WHICH WOULD THEN BE ADOPTED BY ALL LINE DEPARTMENTS AND AGENCIES WORKING ON BEHALF OF THE CROWN. GOVERNMENT COULD ALSO ENCOURAGE THE USE OF THESE STANDARDS BY THE PRIVATE SECTOR.

The need has been identified to develop a framework of standards for recording, classifying, coding and storing data related to land and water management within the Provincial Government and its agencies. Under the guidance of the Provincial Surveys and Mapping Committee, a Manual of Standards is presently being prepared.

These standards are the minimum requirements needed to allow for the orderly presentation of information gathered by or for the government and its agencies. It is hoped that these standards would be adopted by the private sector and by resource developers in the region.

It is recommended that the Surveys and Mapping Committee continue these activities and be provided with the necessary resources to maintain the Standards Manual on an ongoing basis.

(vi) Need for central location (or brokerage) for access to government information

IT IS RECOMMENDED THAT GOVERNMENT INVESTIGATE THE CONCEPT OF A CENTRAL GIS INFORMATION BUREAU FOR GOVERNMENT GENERATED GIS INFORMATION. THIS BUREAU COULD BE EITHER IN GOVERNMENT OR MANAGED BY THE PRIVATE SECTOR ON BEHALF OF THE CROWN.

The concept of central delivery of government GIS related information has been discussed for several years now. Traditionally, the Department of Natural Resources and Energy has been providing to both government and the general public base maps, aerial photographs and some thematic data. Some of these functions have eventually been transferred to LRIS (and MRMS) when this establishment was created by the Council of Maritime Premiers (CMP).

A central location for purely government generated GIS type information is highly supported by all line departments and the consensus is that such a facility should be under the Central Agency for Surveys and Mapping as discussed in section 6.4 (ii). Studies show that up to 70% of government information is geographical in nature.

Another idea discussed, is the concept of a central information service bureau run by the Private Sector on behalf of the government. This bureau would act as a clearing house for information within government and include both electronic and hardcopy data. This bureau would receive information directly from line departments and would have no discretionary power to alter or modify same.

Recommendations are that the Bureau concept be investigated more fully by the government. It has the potential to develop private sector capability in this area. In the context of LANDNET and the proposed provincial data base network, this bureau could become a major access node.

(vii) Need for partnership with the Private Sector

IT IS RECOMMENDED THAT ALL LINE DEPARTMENTS SEEK OPPORTUNITIES TO CONTRACT OUT TO THE PRIVATE SECTOR SOME OF THE GIS RELATED ACTIVITIES NORMALLY UNDERTAKEN IN-HOUSE.

The development of private sector capabilities in GIS is of particular concern to the government of New Brunswick since GIS offers the best economic development opportunity for this province in this Information Age. The skills in GIS applications have so far been confined to line departments, University of New Brunswick and to crown institutes such as LRIS and MRMS. Line departments have in the past directed GIS type work to LRIS and MRMS or have undertaken such activities themselves. Some departments have increased in-house capabilities out of desperation because of the lack of a central policy and because of the need to get things done.

Most departments, however, realize the importance of working with the private sector and are actively seeking their assistance. This is particularly true of DNRE&E (Mineral Development Agreement) where the private sector is encouraged to submit proposals for joint research.

It is with this in mind that the Council of Maritime Premiers adopted the concept of the Champlain Institute. This Institute would encourage linkages between government, universities and the private sector. Private sector will thus be able to undertake GIS activities which have traditionally remained with government.

It is thus recommended that line departments be actively associated with the Champlain Institute and to make every attempt to increase work activities with its members.

(viii) Need for support for Research and Development in GIS

IT IS RECOMMENDED THAT:

(1) GOVERNMENT ENCOURAGE JOINT RESEARCH AND DEVELOPMENT ACTIVITIES WITH THE UNIVERSITY OF NEW BRUNSWICK AND THE PRIVATE SECTOR. SUCH ACTIVITIES SHOULD INCLUDE EXCHANGING INFORMATION AND EXPERTISE (INCLUDING PERSONNEL) WITH EACH OTHER.

(2) GOVERNMENT CONTINUE ITS SUPPORT FOR THE CREATION OF A NATIONAL CENTRE OF EXCELLENCE IN GIS AT THE UNIVERSITY OF NEW BRUNSWICK AND WORK WITH THE FEDERAL GOVERNMENT TO BRING THIS ABOUT.

Maritime strengths in GIS technologies are to a great extent due to research and development activities in the universities and colleges in the region and also in LRIS and MRMS. Of particular importance is the role played by the Department of Survey Engineering at the University of New Brunswick. Within this department is the Centre for Resource Information Studies (CRIS) which is internationally recognized for its excellent work in land and ocean information systems. Arising out of this department is Universal Systems Ltd.'s CARIS software which is regarded as a leading GIS system.

The research and development activities at these institutions have provided us the foundation for all subsequent work in GIS. These institutes have also transferred technology to the private sector which in turn is fuelling R&D activities.

The University of New Brunswick is also promoting CRIS as a Centre of Excellence in GIS and is seeking both Federal and Provincial support in this regard. The government is encouraged to continue its efforts in support of this Centre of Excellence at UNB and to actively encourage line departments to seek linkages with this Centre.

APPENDIX 1

BACKGROUND ON RELATED INITIATIVES IN GIS AND INFORMATION TECHNOLOGY

A1.1 Champlain Institute 48
A1.2 Centre of Excellence in GIS 49
A1.3 LIS'90 - Land Information System 1990 50
A1.4 CARIS - Computer Aided Resource Information System 51
A1.5 LANDNET 51
A1.6 N.B. Government Technology Strategy Study 52
A1.7 Coastal Oceans Information Network 53
A1.8 RADARSAT 53
A1.9 OSI - Open System Interconnection (Fed.Dept.Comm.) 55
A1.10 Memorandum of Understanding and Centres of Excellence in GIS (EMR) 55
A1.11 Bay of Fundy/Gulf of Maine/Geogres Bank Project (FMG) ... 57
A1.12 Canadian Marine Communications Application Centre (CMCAC) 58
A1.13 Atlantic Canada Training and Innovation for Occupation Needs Parntership (ACTION) 58
A1.14 Communications and Instructional Technologies Applications Consortium (CITAC), Atlantic Canada 59

A1. BACKGROUND ON RELATED INITIATIVES IN GIS AND INFORMATION TECHNOLOGY

A flurry of interrelated but unconnected initiatives have surfaced within the region. These initiatives are important and to ensure they are addressed with understanding, this chapter lists and explains each initiative and its objectives.

A1.1 CHAMPLAIN INSTITUTE

Proponents: Governments of NB, NS and PEI
UNB, College of Geographic Sciences (COGS),
Holland College
Private Sector

Sponsors: Council of Maritime Premiers
DOC, DFO, EMR, ACOA, LRIS

Funding Estimates: $15 million over 5 years

The Champlain Institute has been formed to bring together governments, universities, colleges and the private sector to develop a Maritime Industry in geographic information technologies and to develop the technical architecture and plan to facilitate the growth of this industry.

Through its work, the Institute will help to strengthen existing Maritime capabilities in geographic information research and development, training and education. As a result of the work anticipated, public sector use of geographic information is expected to be made more effective and more efficient. The Institute has been adopted by the Council of Maritime Premiers and is being incorporated under the name Champlain Institute. A five year business plan is presently being prepared by the Institute for presentation to the three Provinces for base funding.

A1.2 CENTRE OF EXCELLENCE (UNB)

The University of New Brunswick is recognized as a world leader in the field of land information. It is one of only two universities in North America which have been designated as Centres of Excellence in Land Information Studies by the authoritative Washington-based International Institute for Land Information. The other is the University of Wisconsin, U.S..

Various faculties of UNB were actively involved in the development of:

(a) the Land Registration and Information Service;

(b) the Forest Manager GIS in the Department of Natural Resources; and

(c) Computer Aided Resource Information System.

In 1985, a Resource Information Management Group was established at U.N.B. to coordinate the university's teaching and research efforts in the resource information management field. This is a multidisciplinary group with faculty and staff drawn from surveying and civil engineering, computer science and forest resources.

This Group has been involved with developing the graduate program in land information management, developing advanced management training courses in resource information, investigating the feasibility of implementing a distributed land information network in New Brunswick (The LANDNET Project), studying the design considerations for a land information network in Manitoba, carrying out user requirements studies in P.E.I., Nova Scotia, Newfoundland and the Northwest Territories, developing GIS software for the MacIntosh computer, and building a new laboratory for Integrated Spatial Information Research and Engineering (CanLab INSPIRE).

It is now proposed to further develop and integrate these research and management training programs through the creation of a Centre for Resource Information Studies (CRIS).

CRIS will consist, initially, of three components:

(a) a national laboratory for integrated spatial information research and engineering (Can Lab INSPIRE);

(b) a management research group;

(c) a management training centre.

A1.3 LIS'90 - LAND INFORMATION SYSTEM 1990

LIS'90 is the name given to an annual series of 2-day seminars given by the Department of Surveying Engineering at UNB.

LIS'90 began nine years ago, primarily, through the efforts of Angus Hamilton, then chairperson of the Department of Surveying Engineering at U.N.B.. Each year the organizing committee invites participation from various government departments in the region, private industry and municipalities.

The two day sessions are open to anyone with an interest in the use of land-related information. It has served as a forum to share common experiences, ideas and initiatives on the building of data bases and systems. LIS has received tremendous support from government and industry. Attendance has grown over the years with as many as 90 participants attending in recent years.

The objective of LIS'90 is simply to building confidence in and encourage the development of land information systems within the province by the year 1990.

A1.4 CARIS - COMPUTER AIDED RESOURCE INFORMATION SYSTEM

CARIS is a digital mapping and land information system. It has evolved from a digital mapping laboratory - the brain child of Dr. Salem Masry in the Surveying Engineering Department at U.N.B. - to a marketable, state-of-the-art, computer software system.

CARIS is currently marketed by Universal Systems Ltd. (USL) based in Fredericton. The company presently employs a staff of 22 and has customers in 4 countries outside of Canada. The overall system design is based on data structures and the management of geographical data bases. Applications range from hydrographic chart production to a facilities management system which can be utilized by municipalities and utility companies. The objective of the CARIS system is to provide managers with a tool (a Geographic Information System) that may be incorporated in the work environment of an organization.

A1.5 LANDNET

The term "LANDNET" is used in two contexts. The first is its current form, which refers to a study which began in 1985. This study was largely funded by the Federal and Provincial governments and supervised by the Provincial Surveys and Mapping Advisory Committee.

The study was carried out by the Resource Information Management Group at U.N.B.. The final LANDNET Report makes seven recommendations which address the administrative structures and policies necessary to pursue the development and implementation of the LANDNET network concept.

The second usage is in the context of a functioning land information network which the above-noted study proposes. This

network would link the major individual land-related information systems which exist in the several provincial agencies. This is the main objective of the current initiative.

The development and implementation of a full provincial land information network in New Brunswick should take place incrementally over a number of years. This process can be divided into three stages.

(a) Land Information Management Planning - policies, standards, etc.

(b) Prototype Network - establishment of a nucleus network to enable testing and evaluation of the prototype itself and the network products and services.

(c) Implementation of a fully functioning network.

A1.6 N.B. GOVERNMENT TECHNOLOGY STRATEGY STUDY

This study was done by the DMR Group Inc. on behalf of the Government of New Brunswick. It was completed in July 1987 and made recommendations concerning the overall Information Architecture, the Technology Architecture and Administrate Infrastructure. It recommended that "Geographic Information System (GIS) be highlighted for early action for the benefit of both government and private enterprise". Also included in the recommendations was a proposed Action Plan for the implementation of the Strategy in Government.

As part of the Action Plan, the role of a Chief Information Resource Officer (CIRO) was identified. The CIRO would assume line responsibilities for the following functions.

- Support in establishing and maintaining corporate strategy.

- Support the process of managing the information resource.
- Support the process of managing the information technologies.
- Integrating external and internal data base information and providing access to these facilities.

The Strategy is now being adopted by government. The CIRO's position will be established in Cabinet Secretariat. However, the position will not have support staff.

A1.7 COASTAL OCEANS INFORMATION NETWORK

Department of Fisheries and Oceans

The Department of Fisheries and Oceans (DFO) through its regional office in Moncton is planning a pilot project to build a prototype of the Coastal Oceans Information Network (COIN) based on a version of the CARIS software developed jointly by DFO and Universal Systems Ltd. of Fredericton (USL). The system has already been demonstrated in a Bay of Fundy project with Bedford Institute, DFO and USL.

The COIN prototype project would demonstrate the ability to handle all types of geographically referenced oceanographic data. This project would be equivalent to our LANDNET prototype project now being addressed in this province. It would be a remarkable feat for both the LAND and OCEAN information prototypes to be developed in this province.

The COIN project is presently being addressed such that the network is also capable of merging with the present DFO Marine Environment Data Systems (MEDS). A decision to produce a prototype is awaiting approval of funding from a DFO Memorandum to Cabinet.

A1.8 RADARSAT

Department of Industry Science & Technology (DIST, MOSST))

On June 25, 1987, the Hon. Frank Oberle, Minister of State for Science and Technology and the Hon. Gerald Merrithew, Minister of State (Forestry and Mines) announced federal approval of the ten year, $725 million RADARSAT Program.

RADARSAT would provide weather independent earth observation from space allowing for the improved monitoring of Canada's sovereign right, resources, and overall geographic area. As well, it is perceived to provide Canada with a technological edge in earth observation, the continuation of its national reputation in space activities and significant industrial benefits in both space related industries and radar data user industries.

To underwrite some of the cost of the RADARSAT Program, the Federal Government has negotiated with the provinces a funding arrangement whereby provinces receiving major industrial benefits would be asked to contribute to the cost of the project, and the other provinces being expected to utilize radar information on a radar data purchase commitment basis. New Brunswick has joined other provinces in committing support to the Federal Government on the RADARSAT Program.

Simultaneously, New Brunswick has been negotiating with the Department of National Defense for the acquisition of the aircraft tracking facility at the St. Margaret's station near Chatham, N.B.

The St. Margaret's site has been selected by the Interim Canadian Space Agency as the primary location for the RADARSAT satellite Telemetry, Tracking and Communications Ground Station. The St. Margaret's location is also being considered for the Mission Control Centre for the RADARSAT program. Of the three major projects in the

Canadian Space Program (U.S. Space Station, Mobile Communication Satellite (MSAT) and RADARSAT), RADARSAT provides the best opportunity for New Brunswick to be a vital link in the development and future operation of industries and institutions involved in advanced geomatics.

A successful RADARSAT Program could result in increased employment in New Brunswick, would provide New Brunswick with access to radar based data which is complementary to New Brunswick's existing strengths in surveys and mapping, global positioning and other geographic information system related technologies.

A1.9 OPEN SYSTEM INTERCONNECTION
(Federal Departments of Communications)

Since 1979, Communications Canada has been part of an international effort to develop a framework of standards so that all computers can talk to one another regardless of manufacturer or country of origin. The goal is Open Systems Interconnection (OSI). This concept was successfully achieved in 1983, a world first, when laboratories at Communications Canada and the University of Uppsala (Sweden) successfully linked different computers using OSI-based standards they had implemented independently.

The Federal Government of Canada is firmly committed to the implementation of OSI as the standard model for computer-based information systems in this country. The Hon. Flora MacDonald, Minister of Communications, announced in April, 1987, that OSI is a key element in the government's overall approach to information technology.

Adoption of OSI will also insure that Canada is well positioned in world markets at a time when other industrialized nations are taking important initiatives in this area.

A1.10 MEMORANDUM OF UNDERSTANDING (MOU'S) AND CENTRES OF EXCELLENCE IN GIS

Federal Department of Energy, Mines and Resources

The Federal Department of Energy, Mines and Resources (EMR) has the mandate for mapping which is administered by the Surveys and Mapping Division. This division has been very active in GIS research and adopted the use of digital mapping of the 1:50,000 series as early as the 1970's. The Department also has the mandate to promote the development and use of remote sensing technologies in Canada. This latter mandate is administered through the Canadian Centre for Remote Sensing (CCRS).

Because of the heightened interest in GIS and Remote Sensing, the Department of Energy, Mines and Resources has decided to bring these two activities under one Assistant Deputy Minister and is currently working towards enhancing its federal image as a leading GIS agency.

As part of EMR's strategy to enhance its image, the Minister is considering expanding his Interprovincial/Territorial Advisory Committee (IPTAC) on Remote Sensing to include the subject of GIS.

The Department of Energy, Mines and Resources is also actively pursuing agreements with the provinces for the development of GIS technologies. These agreements are in the form of "Memorandum of Understandings" which will pave the way for more detailed commitments and funding.

EMR has offered the Province of New Brunswick two such MOU's. A MOU for Cooperation in Remote Sensing offered to the province on March 2, 1988, was to facilitate technology transfer from CCRS to line

departments of the government. This MOU could not be accepted because of the lack of remote sensing computer equipment in the province. Without such infrastructure, none of the projects proposed by several line departments could be undertaken.

A second MOU (Appendix 3) on GIS between the Federal Government (EMR) and the province (Department of Commerce & Technology) was signed on June 6, 1988. This MOU has set the stage for further negotiations on the transfer of technology and project funding.

EMR is also promoting the development of a network of Centres of Excellence in GIS. EMR recognizes U.N.B. Surveying Engineering as the leading GIS centre in Canada and hopes to develop the network based on a linkage of UNB, University of Laval and the University of Calgary. Federal recognition of U.N.B. as a vital part of the national network of Centres of Excellence in GIS will do much to add to the credibility of the region and will facilitate research and applications activities with federal assistance.

A1.11 BAY OF FUNDY/GULF OF MAINE/GEORGES BANK PROJECT (FMG)

Proponents: Land Registration and Information Services
Dalhousie University (School for Resource and Environmental Studies (SRES))
St. Mary's University (Department of Geography)

Sponsors: Federal Government $377,000

Council of Maritime Premiers $40,000

Texaco Canada $25,000

The objective of the project is to develop a comprehensive and up-to-date resource and environmental inventory of Canadian and U.S. zones within the Bay of Fundy/Gulf of Maine/Georges Bank (FMG) marine region. The inventory will comprise a digital data base (graphic and alphanumeric) and a computer-generated hard-copy atlas.

Approval of the project was announced by the Federal and Provincial governments on Tuesday, June 21, 1988.

A1.12 CANADIAN MARINE COMMUNICATIONS APPLICATION CENTRE (CMCAC) (ST. JOHN'S, NEWFOUNDLAND)
Federal Department of Communications (DOC)
Atlantic Canada Opportunities Agency (ACOA)

Funding estimates are $15.0 million over 5 years.

This project would establish a Canadian Marine Communications Application Centre in the Atlantic region to conduct R&D in marine communications applications and related areas, transfer technology to industry, and also to plan, develop and manage related regional development projects.

The Centre would carry out, with industry and others, a Canadian research and applications technology development program in communications, navigation and information technologies needed for the future development of fisheries, offshore resources, ocean research and other marine applications.

A1.13 ATLANTIC CANADA TRAINING AND INNOVATION FOR OCCUPATION NEEDS PARTNERSHIP (ACTION)

Proponents: Holland College, P.E.I.

Sponsors: DOC, ACOA, CEIC

Projected Costs: $5-7 million over 5 years

This project will form a partnership of government, industry and educational institutions to:

- -identify existing and emerging occupations
- -determine the employee skills these occupations require
- -develop training modules
- -deliver such training on-site by means of cost effective and advanced communications and information technologies.

ACTION would be an information clearinghouse wherein private industry would indicate its needs and educational institutions such as Holland College would assist industry in occupational forecasting and analysis and in providing training by means of a sophisticated communications network.

A1.14 COMMUNICATIONS AND INSTRUCTIONAL TECHNOLOGIES APPLICATIONS CONSORTIUM (CITAC), ATLANTIC CANADA

Proponent: Atlantic Association of Universities (AAU)

Sponsors: Council of Maritime Premiers

ACOA, DOC

Funding Estimates: $9.9 million over 5 years

A proposal prepared by the AAU was presented to the Council of Maritime Premiers. It proposes to establish an educational resources centre in the Maritimes to serve the four Atlantic provinces to act as a focus of expertise in the use of information technology for education, primarily at the university and college levels; an information reference source; and to support private sector training needs. The consortium would have a regional technology and applications development mission capable of complementing specific initiatives presently underway in various provinces such as Memorial University's Telemedicine expansion, Holland college's training and retraining of the workforce and future intentions of the AAU in instructional communications. The consortium could also implement and operate tele-education trials and services.

APPENDIX 2

CURRENT INFORMATION RELATED ACTIVITIES IN NEW BRUNSWICK

A2.1 In Government 61
A2.2 In University of New Brunswick 61
A2.3 In Private Sector 63

A2. CURRENT INFORMATION RELATED ACTIVITIES IN NEW BRUNSWICK

In addition to some of the initiatives described in Chapter 3, several other information activities are taking place in the province. These other activities occurring in government, the University of New Brunswick and the New Brunswick private sector are briefly listed below:

A2.1 IN GOVERNMENT

1. Science & Technology Information Transfer Study - Innovation Subagreement Department of Commerce & Technology.
2. Interprovincial Library Network - Department of Tourism, Recreation & Heritage.
3. Geographic Referenced System for Emergency Response Personnel and Enforcement Personnel in N.B. - Department of Municipal Affairs & Environment.
4. Remote Sensing Study. "Opportunities for the establishment of Remote Sensing Facilities in Atlantic Canada - Managing Resources in the 1990's" - Preliminary report of the Maritime Remote Sensing Committee April 1988.

A2.2 IN UNIVERSITY OF NEW BRUNSWICK

1. UNB's agreement with UNISYS for the development of a Training Centre. This training facility will provide a service to UNISYS' and Universal Systems Ltd.'s customers.
2. UNISYS has sponsored an annual "Guest Speaker on GIS" series at UNB.
3. NSERC Grants in Communications & computers 1987-1988.

(i) $306,000 (largest NSERC grant given out for 1987-88) "Antenna measurement system" - Prof. J.M. Tranquilla (UNB).

(ii) $263,920 (second largest NSERC grant given out for 1987-88) "Application of differential GPS positioning" - UNB Professors J.M. Tranquilla, P. Vanicek, D.E. Wells, R.B. Langley, A. Kleusberg.

Both these projects will have a major impact on the development and application of Global Positioning Systems (GPS) and of GIS.

4. NSERC Grant under "Forestry and Protection against pest". Dr. Eugene Derenyi (UNB) has received $300,000 for the development of "Analytical geographic information tools for natural resource and fire management in the northern boreal forest". Co-investigators in this project are; Dr. F.R. Steward, Dr. S.E. Masry, Dr. R.W. Wein, Dr. I.R. Methven and Dr. E.W. Robak.

5. National Marine Council.

Prof. D. Wells of UNB has been appointed to the newly formed 21 member National Marine Council established by the Hon. Tom Siddon, Minister of Fisheries and Oceans. Prof. Wells is a leading scientist in Oceanography and Ocean Mapping. GIS is expected to play a major role in Ocean Mapping in the future.

6. International Conference on Ocean Mapping.

This conference, sponsored by UNB, Federal Department of Fisheries and Oceans and the Department of Commerce and Technology, to be held in June of 1989 in Fredericton, N.B. It is intended to draw attention to UNB as a world class

institution in Ocean Mapping.

7. UNB Science Library & Technology Transfer Service upgrade (partly funded under the Innovation Subagreement).

A2.3 IN PRIVATE SECTOR

1. Roy Consultants (Bathurst).

   Presently carrying out a feasibility study for the establishment of an "Information Service Bureau" in the Bathurst area to provide mapping and GIS related services to the municipalities of Newcastle, Bathurst and surrounding areas. The feasibility study is being partly financed by ACOA.

2. UNISYS - USL Joint Venture.

   UNISYS and Universal Systems Ltd. of Fredericton have entered into a joint research and development agreement to develop a UNISYS based GIS system. The three year program will be undertaken in Fredericton.

3. Remote Sensing (Moniteq/MMM/USL Joint Venture).

   Moniteq Inc. of Toronto, has just completed a market study in the Maritimes to determine the need for a remote sensing/GIS service oriented business in N.B.. Assistance for the market study was provided by the Can-NB Industrial Development Subsidiary Agreement. A decision to establish in N.B. is forthcoming.

4. Municipal mapping.

   The three major cities of Fredericton, Moncton and Saint John are seeking federal and provincial assistance to have their respective municipalities remapped using digital technology similar to that done for the City of Halifax. The cities are proposing to have the work done through the private sector

which is also willing to become a financial partner. Estimated costs for such a project would be somewhere between $10M - $15M.

5. LRIS is presently considering the privitization of some of its activities.

6. Utility Concept.

   Information has now become a commodity of trade. N.B. Telephone is presently developing a concept to provide information to users through a "Central Information Brokerage". N.B. Telephone is also interested in participating in the development of the 3-City municipal data bases described in #4 above.

7. GEOPLAN Consultants Inc.

   A newly formed New Brunswick Company providing GIS related services in the transportation sector.

8. GEODAT Information Services.

   A newly formed New Brunswick Company providing GIS and Remote Sensing services to the mining, agriculture, forestry and environment sectors.

9. The Cabot Group.

   A GIS consulting group headed by G. Post (President) of Halifax and D. Coleman (Vice President) of Fredericton.

   Cabot operates out of offices in Halifax and Fredericton. Areas of expertise are in:

   (i) Land and Resource Policy and Program development,

   (ii) GIS Project and/or Program evaluation;

   (iii) GIS Program Costing and Financing,

   (iv) Urban and Regional Planning.

APPENDIX 3

"MEMORANDUM OF UNDERSTANDING ON GIS"

MEMORANDUM OF UNDERSTANDING ON GEOGRAPHICAL INFORMATION SYSTEMS

BETWEEN

THE DEPARTMENT OF ENERGY, MINES AND RESOURCES CANADA

AND

HER MAJESTY THE QUEEN IN THE RIGHT

OF THE PROVINCE OF NEW BRUNSWICK AS REPRESENTED BY THE

MINISTER OF COMMERCE AND TECHNOLOGY

The purpose of this Memorandum of Understanding between the federal Department of Energy, Mines and Resources (EMR) and the Minister of Commerce and Technology is to express and record their desire to cooperate in enhancing the public usefulness of Geographic Information Systems (GISs).

For the purposes of this Memorandum, a Geographical Information System is defined to be an integrated series of computer-assisted processes designed to facilitate the acquisition, storage, analysis, manipulation and presentation of geographically referenced information to satisfy a variety of important needs.

It is recognized by the above Parties to this Memorandum that:

a) GISs are essential and powerful tools required to meet, promptly and efficiently, the ever-increasing demands of modern society for information to ensure socio-economic development and well-being;

b) for the most effective utilization of GISs, it is desirable to develop an integrated, national network of computerized data systems, within the federal domain as well as within and between provinces, with common standards for the identification and transfer of geographically referenced information;

c) a vigorous, coordinated effort by governments, universities and private industry through joint ventures, shared-cost arrangements and contracts is required to bring about such development;

d) the development of GISs and of other related value-added products will have significant export potential and government collaboration and assistance to industry are important for greater Canadian penetration of overseas markets; and

e) vital to the development of GISs and related products is the establishment of Canadian centres of excellence for GIS, with complementary mandates, to provide a milieu for experts from universities, private industry and governments to conduct development work.

Accordingly, the Parties to this Memorandum will endeavour to realize the above aims cooperatively by:

a) assisting private industry in the development and implementation of a domestic and overseas marketing strategy for GISs and related products;

b) exchanging information and expertise (including personnel) with each other, private industry and universities;

c) making unique government facilities and equipment available for development projects as required;

d) entering into joint ventures, shared-cost arrangements and contracts with each other, private industry and universities as opportunities occur; and

e) encouraging and co-ordinating the development of common GIS standards.

Cooperative activities under this Memorandum will be subject to and dependent upon the financial support and human resources available to the Parties. The terms of financing will be established by the Parties before the commencement of activities.

This Memorandum will enter into force upon signature by both Parties and remain in force for five years. It may be extended or amended by written agreements and may be terminated at any time upon 90 days written notice from one Party to the other.

It is understood that the Parties will act voluntarily under this Memorandum and that none of the Parties intends hereby to create any form of contracting or legal relationship.

For the:

DEPARTMENT OF
ENERGY, MINES
AND RESOURCES

The Honourable Gerald S. Merrithew
Minister of State
(Forestry and Mines)

For the:

MINISTER OF COMMERCE
AND TECHNOLOGY,
NEW BRUNSWICK

The Honourable Alfred Lacey
Minister of Commerce
and Technology

June 6, 1988

PROTOCOLE D'ENTENTE SUR DES SYSTÈMES D'INFORMATION GÉOGRAPHIQUE

ENTRE

LE MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES CANADA

ET

SA MAJESTÉ LA REINE

DU CHEF DU NOUVEAU-BRUNSWICK REPRÉSENTÉE PAR LE

MINISTRE DU COMMERCE ET DE LA TECHNOLOGIE

L'objet du présent protocole d'entente entre le ministère fédéral de l'Énergie, des Mines et des Ressources et le ministre du Commerce et de la Technologie du Nouveau-Brunswick est d'exprimer et de consigner leur désir de collaborer à rehausser la technologie et l'utilité des systèmes d'information géographique (SIG) pour le grand public.

Aux fins des présentes, l'expression "système d'information géographique" décrit un ensemble intégré de processus informatisés dont le but est de faciliter l'acquisition, l'emmagasinage, le traitement, l'analyse et la présentation de l'information à référence spatiale afin de répondre à divers importants besoins.

Les parties aux présentes conviennent de ce qui suit:

a) Les SIG sont des outils essentiels et puissants pour répondre de façon rapide et efficace au besoin sans cesse croissant qu'a la société canadienne d'avoir de l'information aux fins du bien-être et du développement socio-économique.

b) Afin que les SIG soient exploités de la manière la plus efficace, il est souhaitable qu'il existe un réseau national intégré de systèmes de données informatisés, tant au palier fédéral que dans les provinces et entre elles, y compris des normes convenues visant l'identification et le transfert de l'information à référence spatiale.

c) Cela suppose un effort vigoureux et concerté de la part des gouvernements, des universités et de l'industrie par le biais de travaux en coparticipation, d'ententes de partage des coûts et de contrats.

d) Le développement des SIG et d'autres produits à valeur ajoutée offre des possibilités avantageuses au plan del'exportation; la collaboration et l'aide offerts par les gouvernements à l'industrie sont importants à une plus grande pénétration des marchés étrangers par le Canada.

e) La création de centres canadiens d'excellence en matière de SIG, dotés de mandats complémentaires, représente un élément essentiel du développement des SIG et des produits connexes, afin qu'existe un milieu où les experts des universités, du secteur privé et des gouvernements puissent se livrer aux travaux de développement.

Par conséquent, les parties aux présentes s'engagent à collaborer à l'atteinte des buts susdits de la façon suivante:

a) aider le secteur privé à développer et mettre en place une stratégie de mise en marché nationale et internationale visant les SIG et les produits connexes;

b) participer à des ententes afin d'effectuer des échanges d'information et de connaissances (y compris échanges de personnel) entre eux et avec le secteur privé et les universités;

c) selon les besoins, rendre accessibles aux fins des travaux de développement les installations et le matériel uniques dont disposent les gouvernements;

d) suivant les possibilités, participer à des entreprises en coparticipation, à des ententes de partage des coûts et à des contrats, entre les parties ou engageant les universités ou le secteur privé; et

e) stimuler et coordonner l'élaboration de normes SIG convenues.

L'activité de collaboration découlant des présentes dépendra des ressources humaines et financières disponibles aux parties. Les modalités de financement seront établies par les parties avant le début des activités.

Le présent protocole d'entente entrera en vigueur dès qu'il sera signé par les deux parties et demeurera en vigueur pendant 5 ans. Il pourra être prorogé ou modifié au moyen d'accords écrits. Le protocole pourra être résilié en tout temps moyennant l'envoi d'un préavis écrit de 90 jours par une partie à l'autre partie.

Il est entendu que les parties agiront de façon volontaire en vertu du présent protocole et que ni l'une ni l'autre n'entend par les présentes créer de liens contractuels ou juridiques.

Au nom du:

MINISTÈRE DE L'ÉNERGIE,
DES MINES ET DES
RESSOURCES

L'honorable Gerald S. Merrithew
Ministre d'État
(Forêts et Mines)

Au nom du:

MINISTRE DU COMMERCE
ET DE LA TECHNOLOGIE DU
NOUVEAU-BRUNSWICK

L'honorable Alfred Lacey
Ministre du Commerce
et de la Technologie

Le 6 juin 1988

G L O S S A R Y

Term	Description	Page
1. ACOA	Atlantic Canada Opportunities Agency	58
2. ACTION	Atlantic Canada Training and Innovation for Occupational Needs	58
3. AAU	Atlantic Association of Universities	59
4. CABOT	GIS consulting company	64
5. CARIS	Computer Aided Resource Information System (A GIS software owned and marketed by Universal Systems Ltd., Fredericton)	51
6. CANLAB INSPIRE	Canadian Laboratory for Integrated Spatial Information Research and Engineering (at UNB)	49
7. CCRS	Canadian Centre for Remote Sensing	55
8. CHAMPLAIN INSTITUTE	A Maritime consortium of Government, Universities and private sector. (Working in GIS research and application)	4
9. CIRO	Chief Information Resource Officer	36
10. CITAC	Communications and Instructional Technologies Applications Consortium	59
11. CMCAC	Canadian Marine Communications Application Centre .	58
12. CMP	Council of Maritime Premiers	42
13. COGS	College of Geographic Sciences (Lawrencetown, NS) .	48
14. COIN	Coastal Oceans Information Network	53
15. CRIS	Centre for Resource Information Studies (Centre of Excellence in GIS at UNB)	45
16. DFO	Federal Department of Fisheries	53
17. DIST	Federal Department of Industry, Science & Technology	53
18. DOC	Federal Department of Communications	5
19. DRIE	Department of Regional Industrial Expansion	7
20. EMR	Federal Department of Energy, Mines & Resources ...	55
21. ERDA	CDA/NB Economic & Regional Development	iv

Term	Description	Page
21. FLIP	Farm Land Identification Program	12
22. FMC	Bay of Fundy/Gulf of Maine/Georges Bank Project	57
23. GEODAT	GIS Consultant specializing in transportation	64
24. GEOPLAN	GIS Consultant in the resource sector	64
25. GIS	Geographic Information Systems Geo-information Systems	iii
26. GPS	Global Positioning System	62
27. IPTAC	Interprovincial/Territorial Advisory Committee on Remote Sensing	56
28. LANDNET	A proposed provincial network to handle GIS type information	51
29. LIS'90	Land Information System Seminars organized by the Department of Surveying Engineering at UNB	50
30. LRIS	Land Registration and Information Services	iii
31. LOIS	Land Ownership Information System	13
32. MEDS	Marine Environment Data System	53
33. MHM	Marshall, Macklin, Monahan	63
34. MONITEQ	A Remote Sensing R&D Company	63
35. MOSST	Ministry of State for Science & Technology	53
36. MOU	Memorandum of Understanding	55
37. MSAT	Mobile Communication Satellite	54
38. NSERC	Natural Science and Engineering Research Council	61
39. OSI	Open Systems Interconnection (Networking protocol developed by DFO)	55
40. RADARSAT	Radar Satellite	53
41. REDC	Regional Economic Development Commissions	v
42. SRES	School of Resource and Environmental Studies (Dalhousie University)	57
43. UNB	University of New Brunswick	vii
44. UNISYS	Unisys Canada Ltd.	63
45. USL	Universal Systems Ltd.	51